An evaluation of the effects of outmigration experience on age at maturity

Steve Haeseker (USFWS) and Jack Tuomikoski (FPC)

Is the hydrosystem of the Columbia River affecting mean age at maturity?

Are mean age at maturity and SARs correlated?

Are changes in the age class distribution of returning adults correlated geographically, between hatchery and wild fish, or among species?

PIT-tag data

Advantages

- High sampling rate
- Consistent sampling
- Coverage of both hatchery and wild populations
- Individual identification
- Allows for survival estimates at several life stages

Disadvantages

- Shorter time series
- Limited physical observations

10 spring-summer Chinook stocks:

Wild	Hatchery
John Day River	Carson, Dworshak, Rapid River, Catherine Creek AP,
Snake River	Imnaha River AP, McCall, Cle Elum, Leavenworth

Is the hydrosystem of the Columbia River affecting mean age at maturity?

More narrow questions:

Does age at maturity differ for transported versus in-river migrants?

Is age at maturity correlated with survival rates?

→ Focused on Snake River stocks

Does age at maturity differ for transported versus in-river migrants?

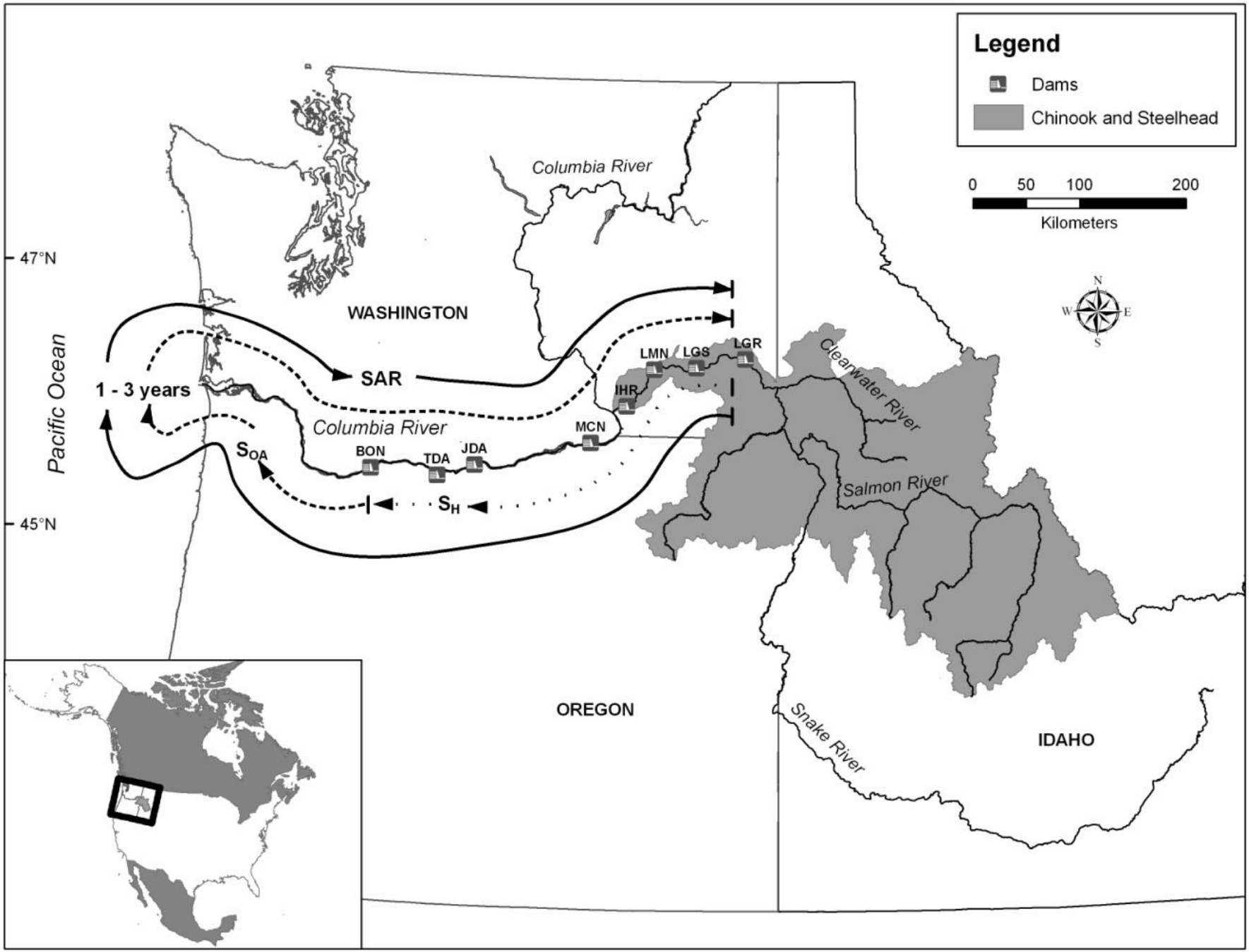
Approach

Compared mean age at maturity for transported versus in-river migrants using paired t-tests

Results

Stock	*P*-value
Snake River wild	0.43
Catherine Creek AP	0.98
Dworshak	0.76
Rapid River	0.97
McCall	0.47
Imnaha River AP	0.82

Conclusion: No difference in age at maturity for transported versus in-river migrants


Legend
Dams
Chinook and Steelhead
0 50 100 200
Kilometers
47°N
45°N
Pacific Ocean
WASHINGTON
OREGON
IDAHO
Columbia River
Columbia River
Clearwater River
Salmon River
Snake River
SAR
1 - 3 years
S_{OA}
S_H
LMN
LGS
LGR
IHR
MCN
BON
TDA
JDA
N
W
E
S

Is age at maturity correlated with survival rates? (Snake stocks)

Approach

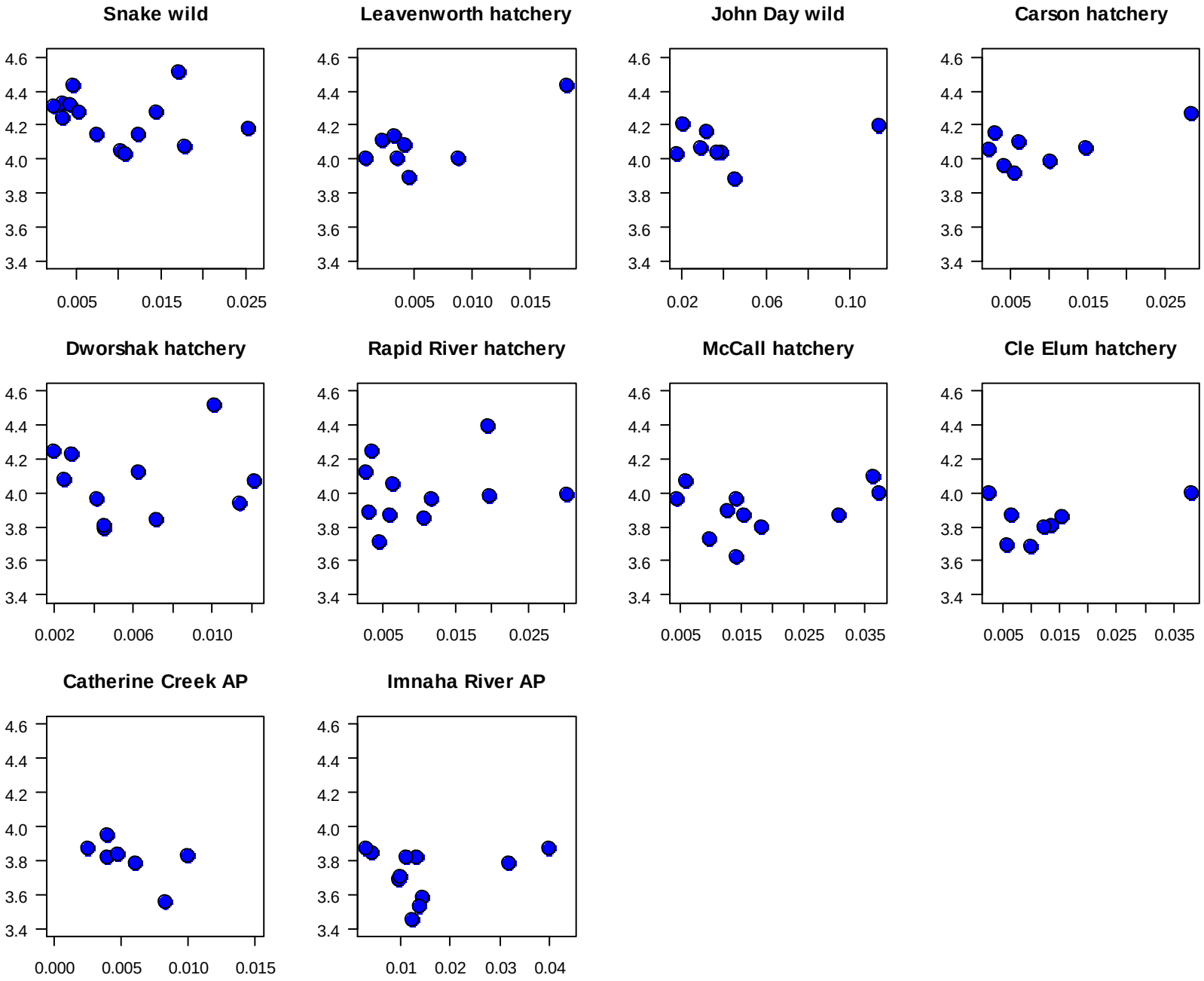
ANCOVA analyses of age at maturity versus S_H, S_{OA} and SAR, along with stock and "year effects"

Results

- Important stock-specific differences in age at maturity (44% of total variation)
- Important year effects (48% of total variation)
- S_H, S_{OA} and SAR accounted for < 2% of total variation

Conclusion: Stock-specific and temporal sources of variation most important in Snake

Are mean age at maturity and SARs correlated?



Are changes in the age class distribution of returning adults correlated geographically, between hatchery and wild fish, or among species?

Approach

Correlation matrix of mean age at maturity

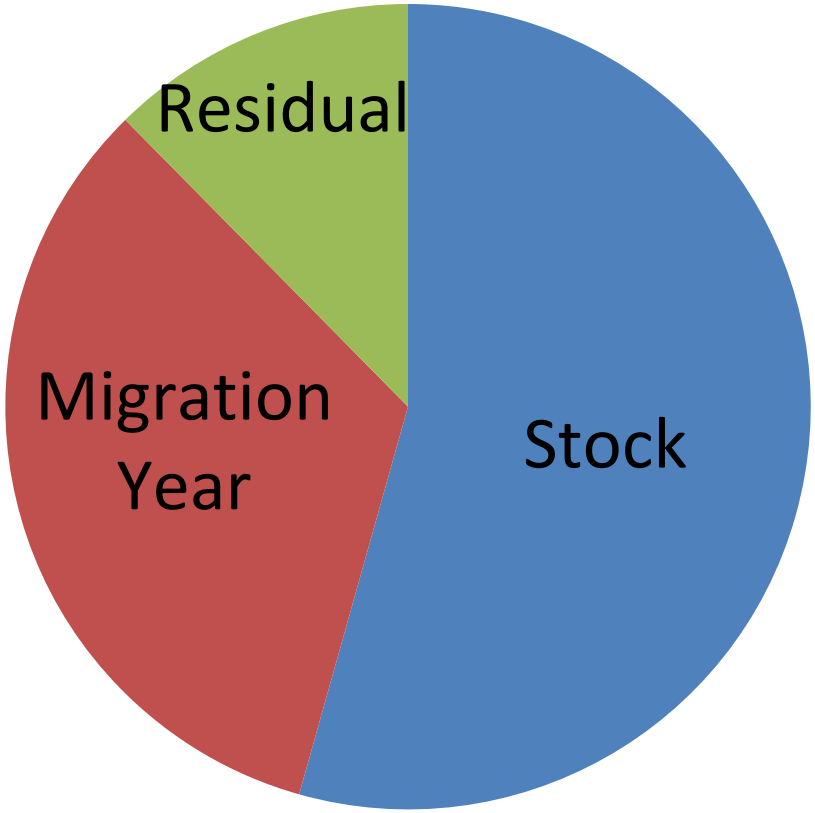
ANCOVA analyses of age at maturity (stock and year effects)

Results

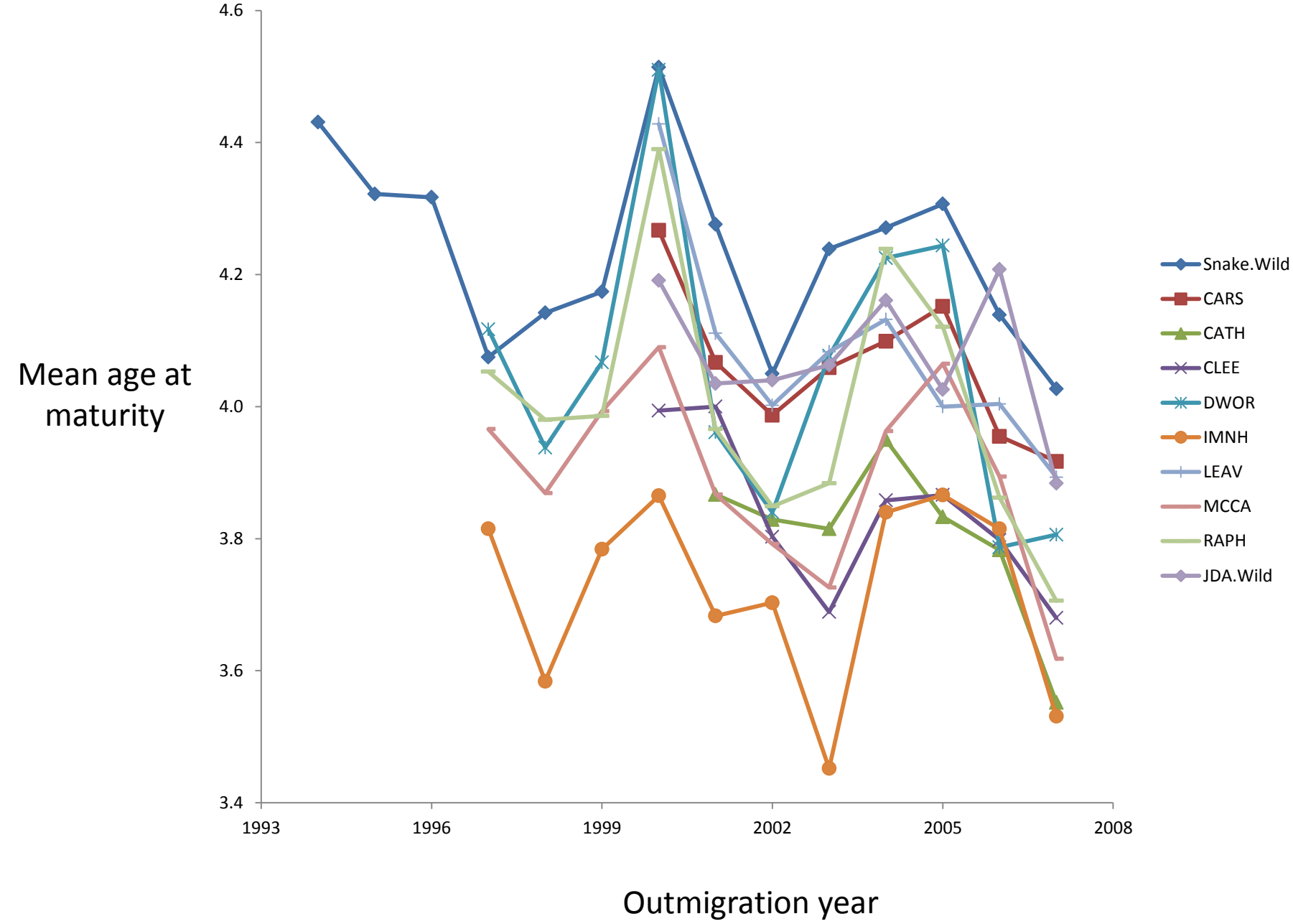
	CARS	JDA.W	CLEE	LEAV	SN.W	DWOR	RAPH	CATH	MCCA
JDA.W	0.5								
CLEE	0.7	0.4							
LEAV	0.8	0.6	0.7						
SN.W	1.0	0.5	0.7	0.9					
DWOR	1.0	0.4	0.5	0.8	0.8				
RAPH	0.9	0.6	0.7	0.8	0.8	0.9			
CATH	0.7	0.7	0.6	0.9	0.7	0.6	0.8		
MCCA	0.8	0.7	0.8	0.6	0.6	0.7	0.9	0.7	
IMNH	0.5	0.6	0.7	0.4	0.4	0.5	0.7	0.5	0.9

Conclusion: High degree of temporal covariation across basin stocks

ANCOVA results

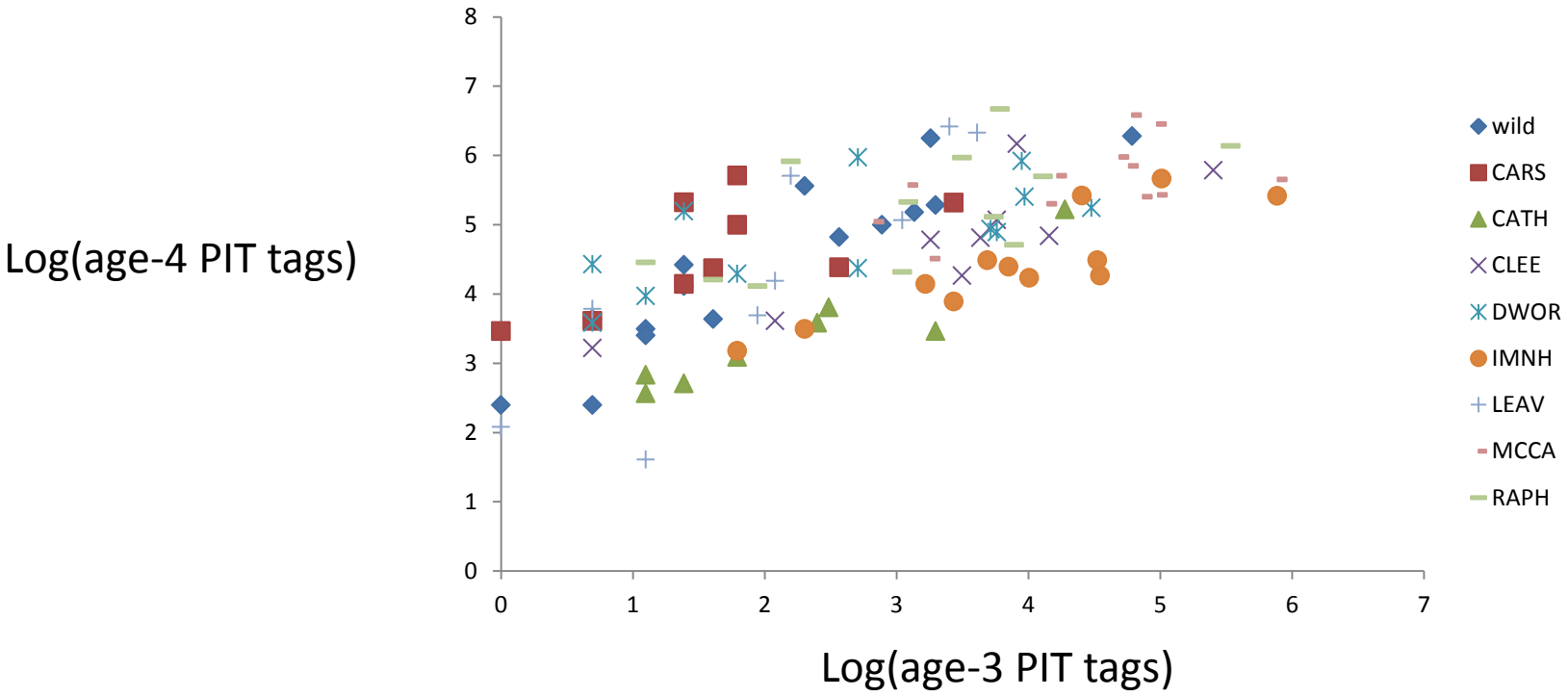


Conclusion: Most variation in age at maturity captured by stock and year effects


Mean age at maturity
4.6
4.4
4.2
4.0
3.8
3.6
3.4
1993
1996
1999
2002
2005
2008
Outmigration year
Snake.Wild
CARS
CATH
CLEE
DWOR
IMNH
LEAV
MCCA
RAPH
JDA.Wild

Using these results to improve management

Stock-specific sibling forecasts



Using these results to improve management

Kalman filter sibling forecasts (Holt et al. 2005)